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Canadian Biodiversity

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An International Forum on Biological Diversity...

research, education and conservation

The goals of Canadian Biodiversity are to:

* *Publish articles on biodiversity*

* *Bridge the gaps between professional disciplines & the public*

* *Communicate information on Canadian & world biodiversity to Canadians*

* *Circulate news on Canadian biodiversity to other countries*

* *Express views on the needs & value of biodiversity research*

* *Discuss methods, principles, ethics of biodiversity conservation*

* *Review books and major articles on biodiversity*

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News, views, articles for publication and books or papers for review should be sent to:

Dr. Don E. McAllister, Scientific Editor
Canadian Centre of Biodiversity
Canadian Museum of Nature
P.O. Box 3443, Station D
Ottawa, Ontario K1P 6P4, CANADA
Fax: (613) 996-9915

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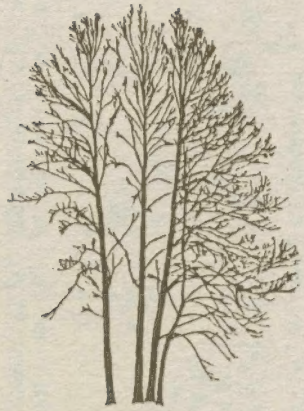

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Whatever befalls the earth befalls the sons of earth. If men spit upon the ground, they spit upon themselves. This we know - the earth does not belong to man, man belongs to the earth. Like the blood which unites one family. All things are interconnected. Whatever befalls the earth befalls the sons of earth. Man did not weave the web of life; he is merely a strand in it. Whatever he does to the web, he does to himself.

Chief Seattle, 1856, **Letter to the President of United States.**

Pays ceinturé d'acier
Aux grands yeux de lacs
A la barbe bruissante résineuse
Je te salue et je salue ton rire de chutes.

Gilles Hénault, **Je te salue.**

Thou shalt love the waters and all things that nourish therefrom;
And thou shalt cherish and protect them as thine own -
For all nature is thy home and all living things are thy kin.

Sheridan Anderson, **Curtis Creek Manifesto.**

Los infinitos seres naturales no podrá perfectamente concerse sino luego que los sabios del pas hagan un especial estudio de ellos.
[The infinite number of natural beings cannot be well known until the scholars of the country have made a special study of them].

Claudio Gay, **Historia de Chile, 1: 14**, *1848.*

One generation plants trees under whose shadow another generation can rest.

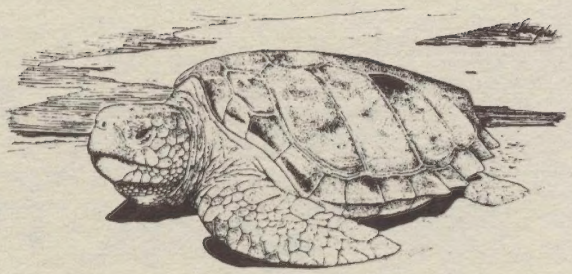
Chinese proverb.

Certaines proposent même de criminaliser la pollution. Si certains actes volontaires méritent d'être criminalisés, c'est plutôt sur le dévlopement d'une conscience écologique qu'il faut concentrer nos efforts de persuasion, car la conscience possède une capacité régulatrice beaucoup plus forte que les interdits et les sanctions.

Donald Guay, 1990, **Pour une écothéque**, Ecozoo 50(1): 2.

*Portrait of the Phantom cranefly, **Bittacomorpha clavipes**. The Phantom cranefly lives in wet marshy areas and in open deciduous woods of eastern North America. The adult cranefly may be seen gliding by in the air, with black and white banded legs, in May and June (sometimes September). The swollen segment in each leg is pillowed out with air sacs and tubes which buoy up the fly as it drifts in the wind. The rusty red larvae live in reddish brown mud amongst decaying vegetation in shallow water, breathing through a "snorkel" which extends through the surface film. The adult cranefly hatches out following a pupal stage. (This portrait, by environmental illustrator, Roelof Idema, is reproduced courtesy of the Diptera Unit, Biosystematics Research Centre, **Agriculture Canada;** the text is by Dr. Fenja Broda, taxonomic expert on the craneflies.)*

What is biodiversity?



Don E. McAllister
Canadian Museum of Nature
P.O. Box 3443, Station D
Ottawa, Ontario K1P 6P4

Biodiversity is a concise new name for biological diversity. In its simplest form it means simply the variety of life or living organisms. Thus **variety of life**, **biological diversity**, and **biodiversity** are all synonyms. Biodiversity is the concise usage preferred here, and in increasing usage. This paper reviews and offers a critique of a number of the fuller definitions that have been proposed. And it tries to formulate, in simple words, a complete definition and a popular definition. Recent definitions include:

For the IUCN *et al.* (1989, p. 38) in their first draft of **World conservation strategy for the 1990's**, "Biological diversity means the variety of life in all its forms. ... The main levels of [biological] diversity are: ecosystem diversity (the number and frequency of different communities of organisms and their environments); species diversity (the number and frequency of different species); and genetic diversity (which here means both genetic variability and the number and frequency of genetically different populations)."

Reid and Miller (1989, p. 3) in **Keeping options alive: The scientific basis for conserving biodiversity**, asserted, "Biodiversity is the variety of the world's organisms, including their genetic diversity and the assemblages they form. It is the blanket term for natural biological wealth that undergirds human life and well-being. The breadth of the concept reflects the interrelatedness of genes, species and ecosystems. Because genes are the components of species, and species are the components of ecosystems, altering the make-up of any level of this hierarchy can change the others. .... Species are central to the concept of biodiversity. ... Just as important, species provide more subtle benefits in the form of wide-ranging ecological services."

NSF (1989, p. 1) in **Loss of biological diversity: A global crisis requiring international solutions,** stated, "Biological diversity refers to the variety and variability among living organisms and ecological complexes in which they occur. Diversity can be defined as the number of different items and their relative frequency. For biological diversity these items are arranged at many levels, ranging from complete ecosystems to the chemical structures that are the molecular basis of heredity. Thus, the term encompasses different ecosystems, species, genes, and their relative abundance."

Stuart and Adams (1989, p. 2) in **Biodiversity in Africa and its islands** asserted, "Biodiversity is the term used to describe the total variety of living organisms (plants, animals, fungi, and microbes) that exist on our planet. Most people have found it convenient to consider biodiversity through three different windows, 'genetic diversity', 'species diversity' and 'ecosystem diversity.' Genetic diversity refers to the variety of

genes (chemical units of hereditary information). It is therefore a measure of variability, both within and between species. Species diversity is a measure of the total number of species in a given area. The world's species diversity is usually estimated at between 5 and 30 million species, though only 1.4 million of these have actually been named by scientists. Ecosystem diversity relates to the variety of habitats (e.g. forests, wetlands, coral reefs, rivers, savannas, deserts) within which species occur. Ecosystems are by definition composed of complexes of species, and they provide the natural cycles of water, oxygen, carbon, nitrogen, sulphur, and other elements, as well as the flow of energy, upon which all life, including human life, depends. The relationships between genetic, species and ecosystem diversity is a complex one, and they are probably best considered as different ways of looking at the same thing. It is impossible to intervene at any one of these levels without affecting the others."

IUCN *et al* (1990, p. 59) in their second draft, **Caring for the world. A strategy for sustainability**, had the following to say, "'The variety of life' and 'biodiversity' (or 'biological diversity') mean the same. They refer to the variety of all life, wild and domesticated, at every level. 'Ecosystem diversity', 'species diversity', and 'within-species diversity' mean the variety of life at those levels. 'Ecosystem diversity' includes cultivated as well as natural and modified systems. 'Biological resources', 'wild resources', and 'genetic resources' mean respectively, biodiversity, wild species and within-species diversity, directly used by people."

FAO (1990, p. 5) in **A draft international convention on the conservation and sustainable use of biological diversity**, proposed the following definition: "'Biological diversity' means the variety of genes, genotypes and genepools and their relationship with the environment at the molecular, population, species and ecosystem levels." Taxonomic levels other than species are not included.

For popular use I propose biodiversity be defined as: *The variety of living beings in an area or on the planet.* The word **beings** stands for microorganisms, plants and animals which are divided into the five currently recognized Kingdoms of life. The word **beings** also expresses the concept that other organisms are fellow life forms, part of the same common family. Biodiversity does not stand alone, it is associated with a given area, a habitat, ecosystem, environment, or the whole planet.

For a technical definition I propose *Biodiversity is the genetic, taxonomic and ecosystem variety in living organisms of a given area, environment, ecosystem or the whole planet.* Genetic variety reflects the diversity in the number of genes or hereditary units. Taxonomic diversity reflects the diversity in the number of taxa - taxonomic units such as species, genera and families. The word taxonomic is preferable because it encompasses differences other than at the species level - 5 species in one genus are less diverse than 5 species in 3 genera. Ecosystem variety reflects diversity in the complexity of ecosystems or in numbers of ecosystems.

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Biodiversity conservation: A moral as well as a practical imperative

Dr. Mostafa K. Tolba
United Nations Under-Secretary General
and Executive Director

Conservation of our planet's incalculable variety of plant and animal life - in current jargon, its "bio-diversity" - is as much a moral imperative as a practical one. Conserving biodiversity is important in practical terms because, whatever strains of super-plants, -animals and -microbes laboratories may create, the world's natural species form the genetic storehouse for humanity's future agricultural and pharmaceutical developments, and, without a rich diversity of species, global ecology would degrade into chaos. But conserving biodiversity is also a moral responsibility if you believe, as I do, that human and non-human species have an equal right to exist on this planet.

The vast increase in human numbers and economic activity this century, especially over the last 30 or 40 years, has subjected the global environment to stresses that will only become more intense as populations rise. Already nearly half of all the world's plants

are gathered and used by people. On our current course of development and population growth, we could be using more than three-quarters of the globe's plant growth by 2050. Even now, humans are devastating forests, overgrazing savannah, overfishing rivers, lakes and oceans, and destroying mangroves and coral reefs.

In some countries, people are forced to destroy the natural environment to provide themselves with food, fuel, and other resources which people in the industrialized world often take for granted. Plans for preserving biodiversity, therefore, have to be as much about people as about animals, trees, water and air. Many of the people who threaten natural resources and habitats, do so just to survive. We can forget about saving our beleaguered natural inheritance until the governments of industrialized nations provide incentives to the rural poor to protect the environment that supports them and, ultimately, the whole planet.

The overall flow of assistance to developing countries for conservation of biological diversity is roughly estimated at US$230 million a year. When it is considered that this is about the cost of an average road building project, it is a derisory sum. By contrast, the World Resources Institute estimates that we should be spending between US$20 and US$50 billion per year on natural resource conservation. Currently only 3.2 percent, or 485 million hectares of the earth's surface is legally protected. Of course, much of this protection only exists on paper. In many developing countries, park services are undermanned, underfunded and demoralized.

But attitudes are starting to change. Brazil has moved from outright rejection of 'debt-for-nature' swaps, to strong governmental support for the establishment of extractive reserves, that provide some people with the right to earn a living from Brazil's forests, while ensuring the habitat retains its full diversity of life.

But, too often, the short-term gain from raising beef on cleared rainforest land, felling mangroves for building materials and fishing off coral reefs prevails over the long-term value of these habitats and their species. However, the forests, swamps, seas, lakes and rivers which support the planet's biodiversity will not even begin to be secure until national accounting, economic and political systems recognize the value of these habitats. Nor will there be any security for the natural world until the poor in developing countries are no longer financially dependent on destroying these habitats. [Reprinted from *Our planet*, the magazine of the United Nations Environmental Programme, 1990, Volume 2, Number 4, p. 2).

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Why save biodiversity? Rationales and ethics.

Don E. McAllister
Canadian Museum of Nature
P.O. Box 3443, Station D
Ottawa, Ontario K1P 6P4

A. INTRODUCTION

The planet's biodiversity is rapidly decreasing under human impacts and faces even more serious future threats unless present trends are reversed. It is widely, though not universally, accepted that we should try to save biodiversity. Reasons for saving biodiversity fall into two major classes: 1) those that would save biodiversity because of its utility to man, and 2) those that believe that other life forms have an intrinsic right to live, independent of man. However there is a third class that considers biodiversity or components of it are essential to sustain the ecosphere, and hence both man and other species. This essay discusses these outlooks and related questions including: Is it wrong to cause the extinction of a species? Which outlook is right? Which outlook is most likely to preserve species and genetic diversity? Which outlook is most likely to preserve humankind?

Is it wrong to cause the extinction of a species or other taxon from infraspecific taxa such as subspecies, to kingdoms? Geologically, natural extinction goes on all the time through competition, geologically induced drying up of lakes, climatic changes, etc. Human-caused extinction differs from the natural process in that humans usually have a choice in whether or not to eliminate a species. Let us therefore coin a word, **taxonicide**, for extinctions caused by humans. Let us note that taxonicide is irreversible, a taxon, once extinct, cannot be revived (we do not yet know the complete genome of even human beings, hence are even theoretically unable to restore a wild species). Our question therefore becomes, is taxonicide wrong? Under premise 1), utility to mankind, some species are useful to humans, hence a resource for the present generation, a potential resource if new uses are developed, or a heritage for future generations. Species in this sense therefore are seen as property or potential property of humanity, not of any individual human being, company, country or other group of humans. Taxonicide under premise 1) thus is wrong because it is taking away irreplaceable property from mankind. The only exception to this reasoning is for "useless species." If it can be demonstrated that a species or other taxon is useless to mankind (see below a fuller discussion of usefulness) and if it can be demonstrated that it will never have a use, then taxonicide would be morally acceptable under the utility premise. However the proof of demonstrating no future possible future use is rather difficult. Most people look with horror on the AIDS virus. But the AIDS genome may very well contain genes that would prevent the rejection of heart, kidney and other transplants. We conclude that under premise 1) that taxonicide is morally wrong, at least for those species useful or potentially useful to man.

Under premise 2), all species and other taxa have an intrinsic right to live. **Ergo**, under premise 2), taxonicide is morally wrong because extinction destroys that right to survive. However, taxonicide might be the lesser of two evils if destruction of one species would save others from extinction. Otherwise, there is the implication that a bacterium, snail and a tiger have the same intrinsic value.

Under premise 3), taxonicide of a species which sustains the ecosphere would be morally wrong, e.g., those that produce oxygen, absorb carbon dioxide, recycle nutrients, create carbohydrates, moderate population sizes, and aerate soil.

Biodiversity also includes genetic and ecological diversity, so we may ask similar questions about extinguishing these kinds of diversity. For human-caused extinction of genetic diversity we may coin the word **allelicide** (the word genocide is already taken for extinguishing human populations or cultures), and for human-caused destruction of ecosystems **ecocide** is proposed. Basically the same ethical arguments stand here as in the last paragraph, as long as the genetic characteristics and ecosystems destroyed are irreplaceable. The word irreplaceable is included to make the particular destruction of genes or ecosystems comparable to loss of a taxon. Thus the destruction of one of many coral reefs (or one component of said reefs) is not ecocide, though it may be an ecocrime, since coral reef ecosystems will continue to survive. But the destruction of any of the last few surviving coral reefs will certainly risk or accomplish the loss of coral reef ecosystems, and so involves ecocide. Trimming the size of a population that has one or more unique genes down to where it is likely to or does disappear, or extinguishing such a population, is allelicide.

I conclude that under either premise 1), 2), or 3) that taxonicide is generally wrong.

B. THE UTILITY ARGUMENT

Mans' needs

To survive people need food and shelter. These needs cover vital needs, those for sustaining life, and not luxury needs. Human food and shelter are for the most part drawn from individuals of living species. Even if a shelter is made of non-living material, living species are cleared or displaced from the location of the shelter, resulting in immediate or delayed death of individual life forms. If fulfilling these human needs ensures survival of the human species and diversity, and if fulfilling these needs does not risk taxonicide, then fulfilment of these needs is morally permissable. But still it must be admitted that the vital needs of existing human populations are resulting in taxonicide. How does the human race solve this? Helping those people to move to a setting where they impact less? Sharing the world's resources better?

Mans' population

If existing humans are allowed to draw upon nature for their vital needs, is it ethical to

permit growth of human populations? Each added human being, however little he or she consumes, pollutes or displaces, does increase the probability of taxonicide. The probability will depend on the area inhabited (how many surviving species, how many humans already there, etc.), from whence are resources drawn, and what regions are impacted. For example a Canadian uses more energy, has a bigger house, more appliances and cars, than those in most other nations, draws upon resources in other countries than his own, is impacting his or her own environment and environments of other countries by polluting the atmosphere and oceans. A fisher in the Maldives impacts species and their habitats far less. But whatever the per capita biodiversity impact is, still adding more people will cause increased taxonicide. Five billion, three hundred million is enough people, and many regions have too many. Zero population growth and in some areas, population decline, is needed to prevent more extinctions. This new ethic asks serious changes of many individuals, governments and religions. If people and institutions see themselves unable to change, they bear the moral responsibility for the loss of biodiversity and the serious parallel consequences to mankind and the ecosphere. Avoiding the ethical issue will not make the consequences go away.

Mans' wealth

There is a saying that "The earth supplies enough for every man's need, but not enough for every man's greed." The seeking of wealth, material gain or power by individuals, corporations, governments or other groupings of human beings often far exceeds the vital needs of many of the individuals involved. To the extent that seeking wealth, materialism or power threatens biodiversity, then it is immoral.

Mans' potential uses of biodiversity

The wealth of biodiversity offers potential benefits for man in new sources of chemicals, drugs, materials, or in terms of new genes that can be used in biotechnology, improved crops or domestic animal stocks, or in curing genetic diseases or even enhancing human performance. This argument is even espoused by environmentalists as a rationale for conserving biodiversity. The potential uses include possible vital and non-vital uses. And the uses may have no, little or considerable impact on biodiversity or ecosystems. So the development of each proposed use requires its own environmental evaluation.

Need for man

To those who ask what is the use of a given plant or animal, one may well reply what is the use of man? Facetiousness aside, one can seriously ask if the species man, *Homo sapiens*, has an ecosystem or ecospheric function. One can reply that man is a terrestrial, air-breathing, generalized, eurytopic (flexible in habitat), large omnivore. In these respects man is not much different from a wolf or a social bear. But man is partially sentient, can gather, share and record knowledge. These qualities have enabled man in a few million years to escape the usual natural controls for rapid population increase that most species encounter. For those qualities perhaps man's role is to ensure that the

multiplication of his numbers, powers and actions do not impact the planet's biodiversity, environments, or ecosphere. So in looking after his own impacts on biodiversity man would be displaying wisdom, since biodiversity loss is irreversible. When that is taken care of man could then begin restoring secondary environmental objectives.

The utility premise may be valid if we include only people's basic needs and exclude greed, and if we limit human populations so that its does not cause taxonicide and allelicide.

C. THE RIGHT TO LIVE

The view that other life forms have a right to live is not a new perspective, it has been around nearly as long as man has had a culture. Some examples are briefly discussed below.

Aboriginal perspective

Indians in North America had a great respect for their environment. Both living and non-living objects were believed to have spirits, and man was regarded by many groups as part of the family of nature, not a superior being placed above nature (Henry Lickers, *pers. comm.*). When a bear was killed, the hunter gave a prayer of thanks to the bear spirit. Indians on the west coast placed strict injunctions on throwing wastes into salmon streams. One of the wisest, holistic and modern-seeming environmental statements to appear was written by Indian Chief Seattle in the mid-1800's to the President of the United States who was seeking to purchase his tribe's land. His letter included the following words, "How can you buy or sell the sky - the warmth of the land? The idea is strange to us. Yet we do not own the freshness of the air or the sparkle of the water... Every part of this earth is sacred to my people." (Clark, 1985).

Chief Dan George of Vancouver wrote (1974) in **My heart soars**:

The beauty of the trees,
the softness of the air,
the fragrance of the grass,
speaks to me.

...

The strength of fire,
the taste of salmon,
the trail of the sun,
And the life that never goes away,
They speak to me.

And my heart soars.

Feminine perspective

The feminine viewpoint has, in many ways, a greater respect for the sanctity of life than the masculine. Women, particularly those in the rural areas of Third World countries, play a major role in managing natural resources - soil, water, forests and energy. Hence they have a profound knowledge of the plants, animals and ecological processes around them (Dankelman and Davidson, 1988, p. xi). Western culture and industry has much to learn from the feminine outlook. For example Patsy Hallen (1987) posits that ecology's wholesomeness is linked in a profound way to the absence of the need to dominate, and that one of the pathways to making peace with Nature is through feminism. She believes that the qualities traditionally associated with women (nurturing, receptivity) are at least equal in value to those traditionally associated with men (self-assertion, power-seeking). And she quotes Hilary Rose on feminist epistemology which emphasizes holism, harmony, and complexity, rather than reductionism, domination and linearity.

"Love thy fellow beings as thyself."

Religious perspective

A variety of religions express some concern or relationships to nature. Some believe that other living beings have spirits or souls. Others believe that man may be reincarnated as an animal. Some believe man was given stewardship of nature, which may imply nature is a possession or a resource. Buddhism is strongly linked to the natural world. Pro-natural or even pro-human religious views can be used as building stones for preservation of biodiversity. For example, the Christian commandment, "Love thy neighbour as thyself." could be the stepping stone to "Love thy fellow beings as thyself."

Evolutionary perspective

Science has shown us that all life forms were descended from a common ancestor, are related to one another to varying degrees, and that many species share genes on their hereditary DNA or RNA strands. This provides us with the knowledge that other species are fellow beings, that we are the surviving part of the family of life. Genetically we now know that more than 90% of our genes are shared with the great apes, that many animals are tool users and communicate with one another by gestures, vocal or other signals. Science also says that we are part of the family of life.

D. ECOSPHERE FUNCTIONS

Man has ecosystem needs beyond his or her vital needs for food and shelter. These include clean air with sufficient oxygen, clean water, a certain range of ambient temperatures, a low level of ultraviolet radiation, and many others. These needs have been met by diversity of the natural ecosystems that have been present on the earth and in its oceans. People have not been generally aware of the relationship between the diversity and number of terrestrial and aquatic plants, animals and microorganisms and these ecosystem-ecosphere products until recently. These ecosystem-ecosphere products are just as important to other members of the family of life as they are to man. Oxygen and carbon dioxide levels, we are now more aware, are moderated by plant and other life forms. Plants supply oxygen for respiration and moderate carbon dioxide levels which influence the greenhouse effect.

E. CONCLUSION

The utility (restricted), right to live, and ecospheric philosophies argue for conservation of biodiversity. Thus they support a moral basis for condemning taxonicide, allelicide and ecocide.

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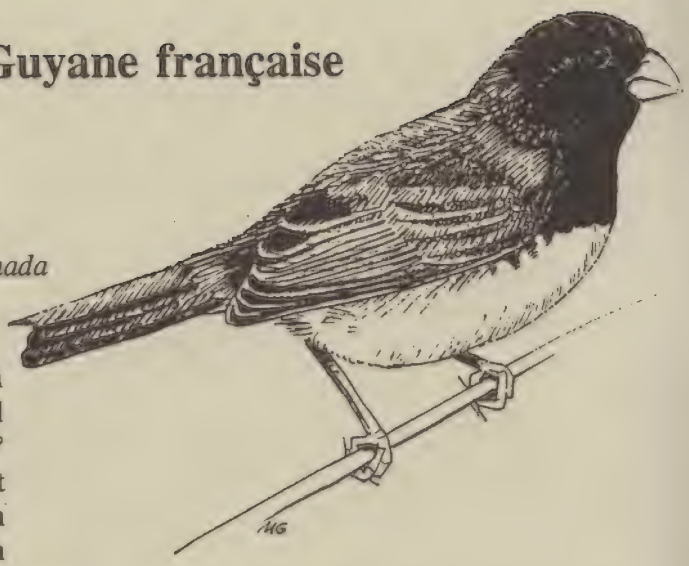
Avian Biodiversity in Guyane française

Henri Ouellet
Canadian Museum of Nature
P.O. Box 3443, Station «D»
Ottawa, Ontario K1P 6P4, Canada



Yellow-bellied Seedeater (Sporophila nigricolis).

INTRODUCTION

Guyane française, a French "Département d'outre-mer", is situated just north of the equator [2° to 6° North, 52° to 57° West] in the vast Precambrian shield of the Guyanas on the Atlantic coast of northeastern South America. The Rio Orinoco borders this extensive area to the west and the Amazon to the east. However, the area occupied by Guyane française is only slightly over 90,000 km^2 or about 6% of the whole region. The topography is relatively gentle with numerous rolling hills ranging around 200-300 metres whereas the highest elevations are all under 1,000 metres. The coast is characterized by extensive tidal mud flats bordered by mangroves and the interior coastal belt displays a mixture of forest patches intermixed with savannas of various sizes and marshes some of which cover several square kilometres. The interior is dominated by an extensive continuous tall forest cover sparingly broken by shorter and more open vegetation in some of the higher or more arid places. Several islands and large rocks occur along the coast such as Grand Connétable and Battures Malmanoury and the best known are probably Îles du Salut to which Devil Island, famous for its reputation as an incarceration centre, belongs. All these habitats support a rich bird life. The population of nearly 100,000 inhabitants is concentrated predominately in the coastal region, although there are small native settlements in the interior primarily on the bigger rivers.

CLIMATE

The climate of Guyane française is equatorial and the mean temperature fluctuates during the day between 26° C and 30° C, and during the night between 18° C and 28° C. However, during the dry season day temperatures may exceed 30° C. There are two main seasons. The rainy season which may last over eight months from November to mid July is broken by a short dry period in March when the rain may stop almost completely. The dry season lasts from mid July to November. The annual precipitation varies considerably over the entire region but is nowhere less than 2,000 mm and may exceed 4,000 mm in some parts.

VEGETATION

Mangrove forests line the entire coast which consists in an extensive unbroken tidal mud flat interrupted by a few small sandy or rocky beaches. The mangrove belt is usually

narrow but can also expand to a few kilometres and form broad stands. This type of arborescent vegetation is characterized by different species of mangroves, each forming different types of associations. All provide shelter or nesting sites to a good number of resident as well as migratory bird species.

Savannas in Guyane française are not extensive like the *llanos* of Venezuela and are isolated from the other savanna systems of northeastern South America. They can be divided into two main types: short grass and tall grass and can be wet or dry. Another habitat similar to savannas can be found on "inselbergs" which consist in rocky outcrops on some of the higher elevations. Savannas may contain bush or tree islands of various sizes often separated from each other by a few kilometres. They are important habitats for many species of resident and migratory birds and are extensively used for agricultural purposes. They are regularly subjected to extensive fires during the dry season.

Swamps support numerous shrubs and trees in addition to an abundant grassy vegetation. Stands of certain species of palm trees are found in this type of habitat. Some of the swamps are seasonal and can become relatively arid during the dry season. Their size is usually limited and not very extensive. They are not continuous and often contain important clumps of bushy or arborescent vegetation, particularly where there is permanent water near the surface of the ground.

Interior forests of Guyane française belong to the lush and moist tropical rain forest system of the Amazon basin. Their main characteristic is the diversity of the trees and other plants growing in them and their physical appearance. The trees are very high and may range from some 15 to 55 metres with a high canopy about 30 to 40 metres from the ground, a relatively open understorey, and numerous liana. They tend to be relatively humid and some can be wet to the extent of resembling certain swamps. When the rain forest is disturbed, either by natural causes or as the result of human activity, it becomes a "jungle" because the area of disturbance is soon overcome by fast growing plants which turn rapidly into an impenetrable green mass. Tropical rain forests cover over 80% of the territory and are mostly undisturbed, except along the main rivers and near the coast.

Coastal islands are not numerous and tend to be relatively small. Most have little vegetation but a few have a more extensive plant cover such as bushes, palm trees, and coconut trees; good examples are some of the islands of Îles du Salut group. Others like Grand Connétable, provide good nesting sites to several species of colonial birds.

GENERAL COMPOSITION OF THE BIRD FAUNA

South America is generally considered for good reasons the "bird continent". The total number of bird species recorded there is greater than that of any other tropical area of the world for a total of nearly 3,000 species, including North American migrants and accidentals. Guyane française because of its geographic position, its size, the diversity of its habitats, other ecological and physical parameters, and its history is not as rich as some of its neighbours like Columbia. However, nearly 700 species of birds have been

recorded to date within its boundaries and include in addition to the breeding species a number of boreal and austral migrants during the boreal or austral winter. In comparison, less than 600 species, including 430 that are known to breed and accidentals, have been recorded within Canada's enormous size of practically 1,000,000 km^2 and seven major life regions.

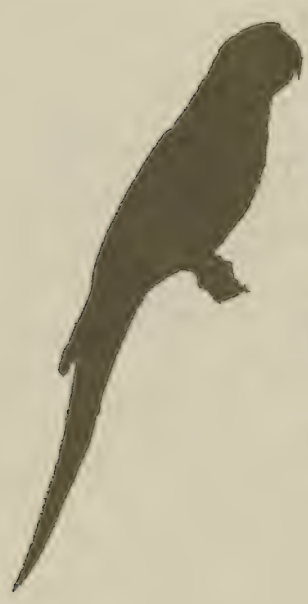
Several avifaunal elements can be recognized in the bird fauna of South America using their origin and their present distribution as the main criteria. The most important group comprises the families primarily restricted to tropical South or Middle America and that are considered as having a South American origin such as: rheas (Rheidae), tinamous (Tinamidae), screamers (Anhimidae), hoatzins (Opisthocomidae), trumpeters (Psophiidae), sunbitterns (Eurypigidae), cariamas (Cariamidae), seedsnipes (Thinocoridae), oilbirds (Steatornithidae), potoos (Nyctibiidae), jacamars (Galbulidae), puffbirds (Bucconidae), toucans (Ramphastidae), woodcreepers (Dendrocolaptidae), ovenbirds (Furnariidae), antbirds (Formicariidae), tapaculos (Rhinocryptidae), cotingas (Cotingidae), manakins (Pipridae), sharpbills (Oxyruncidae), and plantcutters (Phytotomidae).

The next group is less important but includes families considered to have evolved in tropical Middle America and colonized South America at a later time. Curassows (Cracidae), hummingbirds (Trochilidae), and tyrant flycatchers (Tyrannidae) belong to this group, and a number of Emberizidae like tanagers (Thraupinae) and troupials (Icterinae) may have a similar origin.

A few families believed to have a pantropical origin such as parrots (Psittacidae), trogons (Trogonidae), and barbets (Capitonidae) are widely distributed in South American tropical forests.

Families or subfamilies of North American origin such as vultures (Cathartidae), motmots (Momotidae), thrashers (Mimidae), wrens (Troglodytidae), wood warblers (Parulinae), vireos (Vireonidae), and dippers (Cinclidae) are well represented in South America by the presence of numerous breeding and resident species or by migratory species coming to South America during the boreal winter.

Old World families and subfamilies have found their way to South America and are represented at least by a few species of crows (Corvidae) and thrushes (Turdinae) or by many species of pigeons (Columbidae).



Cosmopolitan groups with an uncertain origin have various representatives throughout the continent. Most notable are the barn-owls (Tytonidae), owls (Strigidae), hawks (Accipitridae), falcons (Falconidae), goatsuckers (Caprimulgidae), swifts (Apodidae), woodpeckers (Picidae), swallows (Hirundinidae), and bananaquits (Coerebinae).

The distribution patterns of these families and species varies highly in South America but centres of relative abundance and endemism have been recognized. One such centre, known as the Guiana Centre, comprises the northeastern Amazonian forests, including

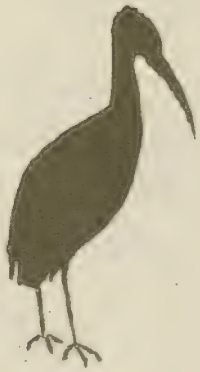
Guyane française. This centre is characterized by the large number of taxonomically isolated species and subspecies. It can also be considered as an important refugium during the arid climatic periods of the Pleistocene during which speciation took place in several groups of endemic forest birds. Birds found in other habitats have probably colonized the area from other regions as new habitats became available. Their relative isolation over a long period of time has resulted in much speciation.

CONSERVATION

The population of Guyane française grows rapidly and the development associated with this recent phenomenon produces strong pressures on the environment. Savannas are taken over so rapidly for agricultural or industrial purposes that their future has become very uncertain. Tropical forests are exploited but do not seem, at present, under extreme stress. However, they will require protection in the near future as the demand for tropical woods continues to increase. The bird species that occur in large numbers on the muddy coastal tidal flats, like migrating or wintering North American shorebirds, enjoy a relative safety but they are subjected to increasing pressures from hunting. The same pressures apply to almost any forest or savanna bird if it is large enough to serve as a source of food. Similarly, numerous songbirds and parrots are taken for the captive bird trade. In spite of existing regulations, little is done to limit adequately hunting and to abolish poaching, or to eliminate the capture of live birds for the trade because of a lack of means. Although the situation does not appear to have reached a critical stage at the moment, it should not be allowed to continue any longer.

CONCLUSION

Considering the size of its territory and the diversity of its main life regions, Guyane française supports a highly diversified bird fauna. This high diversity results from an assemblage of avian elements of several origins in addition to the high number of autochthonous species, and from the forest habitats that have been maintained in a relatively undisturbed state, at least until recently. Carefully conceived and at the same time rigorous conservation measures have become essential to insure the future of avian and general biotic diversity in Guyane française.



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The U.S. Biodiversity Act

Biodiversity Bill re-introduced in U.S. Congress

K. Elaine Hoagland
Association of Systematics Collections
730 11th Street, NW, 2nd Floor
Washington, DC, 20001, U.S.A.
Tel.: (202) 237-2850, Fax: (202) 347-0072

The National Biological Diversity Conservation and Environmental Research Act, a bill that would create a National Centre for Biodiversity and establish U.S. policy to protect biodiversity, was re-introduced in Congress in January, 1991. The bill's chief sponsors are Congressman James Scheuer and Senator Patrick Moynihan, both of New York. Scheuer and Representative Claudine Schnieder of Rhode Island were the original co-authors of the bill in the 101st Congress. The bill has been given the number S 58 in the Senate.

During the 101st Congress, hearings were held on the bill by the House Natural Resources Subcommittee, and the bill was favourably reported out of full House Science Committee in late 1990. However, the legislation was stalled in the Merchant Marine Committee, which also has jurisdiction over it. Although the bill was introduced in the Senate, hearings were not held, in part because the Senate was occupied with the Clean Air Act and in part because Senate staffers were waiting to see the form of the bill when it came out of the two House committees. The bill must begin from scratch in the new Congressional session, but the hearing record from the previous Congress and the momentum gained should work in its favour.

In addition to creating a national biological diversity and environmental policy with the advice and counsel of the **National Academy of Sciences**, the Council on Environmental Quality is required to identify those biotic communities, species and populations that appear to be in significant decline. The legislation requires each federal agency to review its programs for consistency with the conservation of biological diversity. An interagency working committee is established under the bill to prepare a coordinated Federal strategy for conservation of biological diversity.

Of particular interest to the systematics research community is a provision to create a **National Center for Biodiversity Research** at the **Smithsonian Institution**, in co-operation with the **U.S. Environmental Protection Agency**, that would provide an assessment of our knowledge about biodiversity and would identify gaps in that knowledge. If funded through Congressional appropriations, the Center could provide contracts to institutions and research groups to fill gaps in our information and to produce guides, keys, distribution maps, and other projects of use to federal agencies and others in the effort to protect and utilize biodiversity. The Center also could be a data center,

house a "database of databases" on biological resources in the United States. Some see the **Bureau of Flora and Fauna of Australia** as a partial model for the U.S. Center.

Senator Moynihan began his statement to the Senate on January 14, 1991, with these words: "I rise today to introduce a bill to initiate a research program to better understand and conserve biological diversity." Thus there is a clear intention that the legislation provide critical links between the scientific community and government agencies responsible for management of natural resources. In the past, U.S. conservation issues have been debated primarily by lawyers, politicians, and special interest groups, with little role for basic scientific information. The **Council on Environmental Quality**, for example, has had no scientist on staff for several years.

Many systematists and ecologists within the United States have become active participants in Washington. They see their role as providing data to inform policy. The goal of this legislation is to bring scientists and scientific information to bear on public policy decisions affecting land use and the preservation of biodiversity. Currently, such decisions are made using incomplete information at best. It has been the goal of **ASC** to educate policy makers as to the importance of systematics and taxonomy in conservation decisions, and to bring systematists, conservation groups, and users of natural resources together to plan for the kinds of studies that are needed to make policy and individual decisions about our biotic heritage.

International aspects of the biodiversity problem are not emphasized in the House version of the biodiversity bill, but inclusion of them at an early stage in development of the legislation would have required referral to yet another Congressional committee. Since each committee has its own interest to be considered, multiple referrals make passage of legislation increasingly difficult. However, the Senate, with its more streamlined committee structure, added an explicit international component to the legislation. Moynihan's bill directs federal agencies to support existing international conventions related to biodiversity, such as the **Convention on Trade in Endangered Species** (CITES) and the **Convention on Wetlands** (RAMSAR). The **U.S. Agency for International Development** is directed to hire technical staff with expertise in environmental issues and biodiversity. Federal agencies are asked to "support basic and applied research towards understanding ecological systems and applying that knowledge for sustainable development ... internationally, including cooperative research and scientific exchange with governmental, education, and research institutions."

Politically, the bill has several hurdles to overcome in 1991. One potential problem is the loss of Claudine Schneider from the House of Representatives. She gave up her House seat and was defeated in her Senatorial bid. Her presence on both the House Science and Merchant Marine Committees was a definite plus for the bill in 1989-1990. Another problem is that the Senate will be concerned in 1991-1992 with clean water legislation.

HR 1268 is a complex piece of legislation because it has a research component, an

education component (albeit weakly-defined), and a potential regulatory mission, in that it provides for the collection of information to be used for policy purposes. However, implementation of the legislation would affect federal agencies' operations, not activities of the general public.

There is confusion among some House and Senate staff members as to the definition and limits to biodiversity. They worry about the enforcement of legislation calling for protection of biodiversity, when the term can be interpreted so broadly. It is up to scientists to help provide the appropriate definitions and interpretations. A new lunch discussion series at the National Museum of Natural History for systematists, conservation NGO's, and federal agency representatives instituted by ASC should help provide some of the answers sought by the legislative staffs.

The systematics community is forging links with conservation groups to support the concept of a **National Center for Biodiversity**. K. Elaine Hoagland of **ASC** and William Weeks, Chief Operating Officer of **The Nature Conservancy**, have agreed in principle to work together on a mutually acceptable version of the bill. The **Sierra Club** has raised the biodiversity issue to its national agenda; formerly it was being handled by regional offices. **ASC** is preparing a report for the **Smithsonian Institution** on the potential form for the **Center** within that institution, including an organizational chart, funding requirements, and relationships with existing programs.

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Proposed UNEP Convention on Biological Diversity

John Whiting
Canadian Wildlife Service
Environment Canada
17th Floor, Place Vincent Massey
Hull, Québec K1A 0H3, Canada

UNEP

Biodiversity conservation is a global issue with significant implications and is now receiving attention worldwide. It is in all our interests to have countries conserve their biodiversity so that it will be accessible to us all, as well as exist for the contribution it makes to the global balance of nature.

The **United Nations**, some of its agencies, and various NGOs have been involved in the issue of conservation of biodiversity for some time. For example, the United Nations adopted the **World Charter for Nature** in 1982, which expresses support by governments of the principles of conserving biodiversity. There are also several legal instruments which focus on specific aspects of the complex issue, for example, **CITES** deals with trade in endangered species, the **Ramsar Convention** is concerned with the

preservation of wetlands, and the **World Heritage Convention** includes the conservation of natural areas. Given the enormous contribution of tropical forests to global biological diversity, the **Tropical Forestry Action Plan** also represents a significant effort in this regard. International Organizations such as the **World Conservation Union** (IUCN) and **World Resources Institute** are very active in this field. **IUCN** was responsible for developing the **World Conservation Strategy**, and is cooperating with the **United Nations Environment Program** (UNEP) on developing an "international legal instrument for the conservation of biodiversity."

In May 1989, the Governing Council of **UNEP** decided that an "international legal instrument on the biological diversity of the planet" would be developed. Four **UNEP** meetings of an Ad Hoc Working Group of Experts on Biological Diversity have been held with Canada participating in the last three. I participated in the last two meetings as a member of the Canadian Delegation. The first meeting had 20 countries participating, the second had 40, and the third and fourth had almost 80. Although the discussion were still quite preliminary, there was general agreement that a convention with legally binding protocols would be necessary to conserve biological diversity.

The Executive Director of **UNEP**, Dr. M.K. Tolba, is working towards such a document for signature at the 1992 **United Nations Conference on Environment and Development** in Brazil. Since this is a very complex and vast issue it may be difficult for a meaningful document to be ready for 1992, but the process is now well underway with the hope of meeting this deadline. At the same time, negotiations on a convention on climatic change, the development of an agreement or convention on forests, and the 1992 United Nations Conference on Environment and Development have implications for a biodiversity convention. Also, all three conventions have proposed deadlines at the 1992 U.N. Conference.

At the third session of the **UNEP** Working Group (July 9-13, 1990) there were detailed discussions on the needs and costs of conserving biodiversity, access to genetic resources and biotechnology, intellectual property, funding mechanisms and preliminary considerations of draft elements of a convention. A sub-group to examine biotechnology as a related issue was formed, and met just before the larger fourth working group session in November in Nairobi which considered these and other elements for such a convention.

Estimated costs for implementation of such a legal instrument range from hundreds of millions to many billions of dollars. Canada proposed that the ideas of "investment" and "opportunity costs" should be integrated into the examination of costs and needs. The enormous costs currently being discussed would likely impede any real progress without these notions. The **Ecosystem Conservation Group** (this is an interagency group with representation from **FAO, UNEP, UNDP, IUCN, WWF**, in consultation with the **World Bank**) has been asked to help **UNEP** in addressing the issue of costs and benefits. There are 10 countries to be examined as "case studies" to illustrate the costs of biodiversity conservation. Canada was able to get its ideas of opportunity costs incorporated into the

terms of reference for the case studies.

Apart from the seemingly impossible deadline of mid-1992 for a completed convention, access to biotechnology, whether or not it relates to biodiversity conservation, is a major issue for the developing countries. It is perceived as the key to them being able to develop and profit from the genetic resources that occur naturally in their territories. From their point of view, technology transfer must be a fundamental part of the proposed convention, despite difficulties pertaining to intellectual rights, farmers' rights, access, sovereignty, and business considerations. While there are many difficulties in bringing together the diverse interests, Canada is collaborating to create as meaningful a convention as possible within the constraints of time and complexity.

At the last **UNEP** Working Group meeting, there was a more detailed consideration of the draft elements. Dr. Tolba is to provide a draft convention for negotiation in advance of the next meeting of the Legal and Technical Experts. It will be compiled from the draft elements that have been proposed by the Ad Hoc Working Group of Experts. He plans to convene a legal and technical working group to start negotiations on this convention in February/March 1991, and has planned four to five meetings for this year.

In Canada, the management of natural resources is a shared responsibility between the federal government and the provinces and territories. While the federal government is primarily responsible for negotiations and implementation of international agreements, it needs the cooperation of its domestic partners, i.e., provinces, municipalities, NGOs, businesses, etc., in the implementation at the domestic level. It is a major task getting all the players on side in Canada, and even a bigger one getting the international interests to agree on the content of such a convention. But what could be more worthwhile or imperative, given that what is at stake in this convention is **all life on earth!**

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Maps of the number of tree species in Canada: A pilot GIS study of tree biodiversity. Part 1.

Frederick W. Schueler
R.R. 2, Oxford Station
Ontario K0G 1T0, Canada
& Don E. McAllister

INTRODUCTION

Much concern has been expressed in Canada over loss of forests and particularly timber production because tree planting and natural regeneration have not kept pace with logging. Less concern has been expressed over biodiversity.

The biodiversity of Canada's forests is threatened by a number of human activities. The loss of land to cities and agriculture threatens entire Canadian populations of some species in the southern parts of Ontario. Widespread planting of selectively or clonally propagated trees pollutes the gene pools of wild species. Acid rain and other chemical pollution weakens forests on a regional basis. Many modern logging practices, especially widespread clear-cutting, breaks up and destroys populations of non-tree forest species. Only now is Canada moving from timber management to forest management, where biodiversity, ecosystems, watersheds and multiple uses are considered in management (Dunster 1990).

Some tree species are at risk in Canada. Rare, threatened or endangered species of trees in Canada include: American Chestnut, Blue Ash, Cucumber Tree, Dwarf Hackberry, and Kentucky Coffee Tree (Argus and Pryer 1990). Thirty-two of the 39 rare tree species of Ontario occur in the Carolinean Zone, located in the southern "prong" of the province lying between lakes Erie and Huron.

The biodiversity of trees is a topic of interest in itself. To that topic can be addressed such questions as: where are the hotspots where tree species are most numerous, how does biodiversity relate to precipitation and temperature, to what degree does present distribution of trees reflect the glacial refugia in which trees survived the last glaciation, how much does tree distribution depend on altitude and latitude? What variables determine the tree line? Thus primary research on tree biodiversity can produce information on a number of fundamental geographic patterns and environmental constraints to tree diversity.

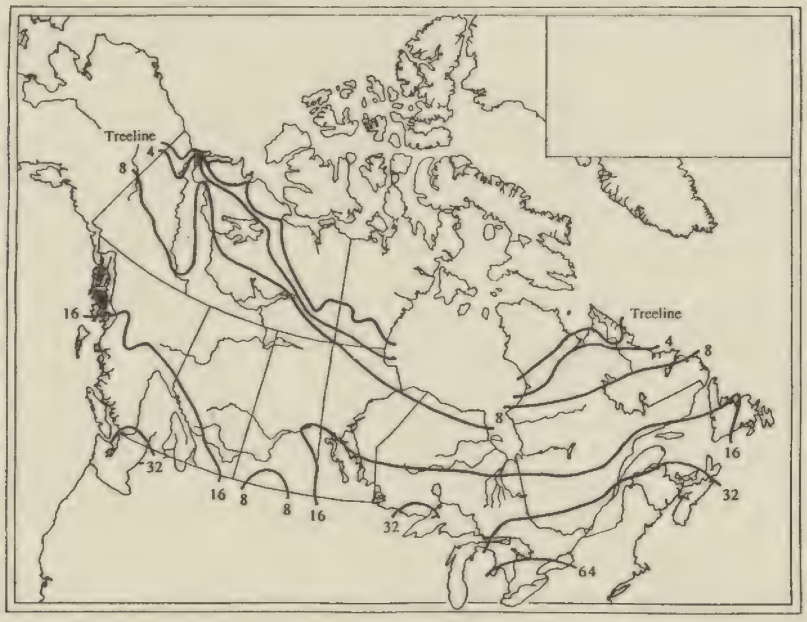

Fig. 1. Number of tree species in Canada.

The results of primary research on tree biodiversity is also of value to second tier research. Trees, as the most massive and structurally complicated three dimensional terrestrial and subterrestrial living structures, provide habitats for other forest organisms. Forests help regulate flow of rivers after rain and during snow-melt, moderate temperatures of rivers, and provide input of leaves, insects and other food materials for stream detritivores and fishes. Knowledge of tree biodiversity is of obvious value in the optimal selection of nature reserves and parks. Combining tree biodiversity and acid precipitation data better enables one to predict secondary impacts. Predicting the impacts of global climatic change requires analyses of present day climate and biodiversity. Biodiversity should be considered in planning logging and in reforestation plans.

We attempt here to provide preliminary answers to such questions as: where are 'hotspots' for all trees, deciduous trees and conifers in Canada; what areas are associated with low species density, and how do numbers of tree species vary with latitude. A pilot geographic information systems (GIS) approach is used to analyze patterns in the data and relationships between environmental and anthropogenic factors. The first part of the paper provides the methodology, shows and discusses the results from a qualitative point of view. The second part of the paper, to be published later will carry out quantitative analyses. We view this pilot study as explorations in advance of a study using an equal-area grid system and a more detailed data base.

METHODS

These maps were prepared by FWS in 1978 for endpaper illustrations for Karstad (1979), but not used. The small scale range maps in Hosie (1969) were transferred to 1 x 2 degree cells of latitude x longitude. Willow (*Salix*) and Shadbush (*Amelanchier*) species are not mapped individually by Hosie, and maps for 3 *Salix* and 1 *Amelanchier* species were taken from Preston (1961) and Brockman (1968). No Hawthorn (*Cratageus*) species were included. Apparent species number is inflated in some places by acceptance of botanical "species" which freely hybridize in areas of sympatry (e.g., named forms of White Spruce, Jack Pine, and Poplar), and are counted as 2 species in the zone of intergradation. The Queen Charlotte Islands were not included in the maps.

Isopleths were then drawn for the number of coniferous, deciduous and all tree species using overlays on the species density maps. These isopleths are depicted in Fig. 1 to 3 in the present paper. The matrices of cell species counts will be used for analyses in the second part of the paper, and were used in the construction of Figure 4, which shows transects through the map at 67°, 83°, 107°, and 119° W longitude.

The biodiversity data will be tested against environmental variables in part 2 of the paper. The trend surfaces of principal components of North American climate from Schueler (1982) will be used to compute the climatic conditions for each geographic cell as in McAllister *et al.* (1986). Relationships between tree species numbers and these environmental variables will be computed using bivariate and multivariate correlations. The 0.02 level of probability is chosen as significant.

Fig. 2. Number of coniferous tree species in Canada.

This paper is a preliminary study of tree biodiversity in Canada. It is preliminary because the data level is coarse and the cells in the geographic grid shrink polewards. Despite similar problems McAllister *et al.* (1986) drew useful conclusions on the biodiversity of North American fresh water fishes. We feel that this analytical level is sufficient for a preliminary study at the nation-wide level. For discussion of the pros and cons of different grid sizes see McAllister *et al.* (1986). For analyses requiring finer geographic resolution and for subsequent more in-depth studies, we would recommend a more detailed data source and an equal-area grid system such as that described by Alfonso (1991).

RESULTS & DISCUSSION

The following patterns in tree biodiversity in Canada may be readily observed in the tree isopleth gradients. The patterns are substantive and some of the relationships will be quantified in part 2 of the paper.

1) The number of species of trees is greatest in, and declines away from, southernmost Ontario and the Lower Mainland of B.C. These two "hot spots" are close to Appalachian and West Coast glacial refugia. The Ontario hot spot coincides largely coincides with the Carolinean Zone and contains the greatest concentration of rare trees in Canada. After glaciation, broad-leaved trees moved northward from the southeastern United States, and those species became established that can survive the winter by super-cooling their cell contents. Broadleaf Forests end abruptly and are replaced by

coniferous forest at a line where the trees face winter temperatures below -40 C. This line is roughly matched by the 32-species isopleth, but there does not seem to be a major step in species number associated with it (Figure 4). On the West Coast, summer drought and large winter-growing conifers rather than winter temperatures limit the northward penetration of broad-leaved species. Of the two dozen genera of broad-leaved trees found north of the Great Lakes but not through the Boreal Forest, half are found along the West Coast, but only four reach north to glaciated territory (i.e., Canada) there. Western broad-leaf trees are mostly species of genera also found in the boreal forest, and there are few species (maximum of 17 spp. per 1 x 2 cell vs 61 in the east).

2) East of Manitoba, the isopleths run roughly west-east, with only a slight southward depression of the 8-species line SW of Hudson Bay. These lines, which represent a doubling of the number of tree species, are spaced fairly evenly latitudinally (Figure 4), so that the tree flora doubles with every 3-4 degrees south. The mid-Boreal Forest band (8-16 species) is the broadest, with its "typical mid-Canadian" tree flora of at least White and Black spruce, Fir, Jack Pine, Tamarack, White Birch, Aspen, Poplar, and Alder.

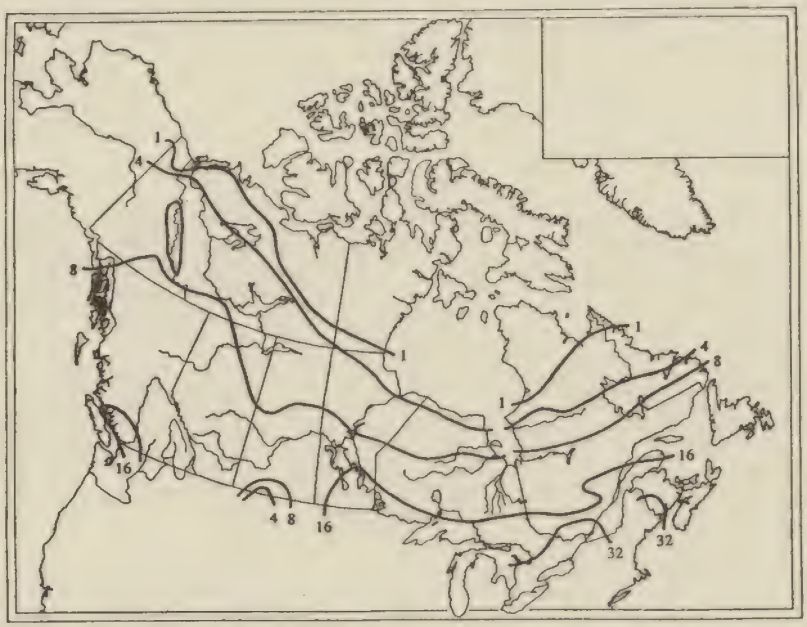

Fig. 3. Number of deciduous tree species in Canada.

Between eastern Manitoba and the Rocky Mountains there is no regular increase in species southward, as Boreal Forest species are 'stretched' between the northern tree line and the prairie tree line. The number of species decreases to the south in central Saskatchewan (Figure 4). Boreal Forest diversity (8-16 spp.) continues across northern B.C. and the southern Yukon, increasing southward with specialized alpine species on the heights and coastal species along the valleys, and then, farther south, warm-coastal species in the Lower Mainland.

3) Timberline is near where the warmest month averages 10°C, or, more directly, where the annual sum of daily leaf temperatures above 10°C is about 800 (Arno 1984). The northern treeline, a transition mosaic of tundra and taiga, varies from 60 to 340 km in width but averages about 145 km (Timoney 1990). The treeline reaches higher latitudes in the Western Arctic than the Eastern Arctic. This seems related to the antilatitudinal thermal transport (McAllister 1961; 1965) of the Yukon, Mackenzie, Anderson and Horton river systems, and to possible climate moderation by lakes Athabaska, Slave and Bear. A small northward bulge in the Québec-Labrador Peninsula treeline may similarly be related to thermal transport by the Rivière Caniapiscau-Koksoak and the Rivière de la Baleine. Timoney (1990) discussed a number of the variable influencing the northern treeline. A test is possible between the southerliness of headwaters of northward flowing streams and the northward extension of the tree line.

4) There are fewer species of conifers, and the number of species is more uniform than broad-leaved species. The number of species of conifers and angiosperms generally is fairly closely correlated, except in southern Ontario where, in the Broad-leaf Forest, conifer species numbers do not increase, and even decline to the south. Conifer diversity declines from areas of species richness in southern B.C. and Alberta, where species are often altitudinally segregated into different habitats, and central Ontario and New Brunswick, where many species often grow together in mixed forests.

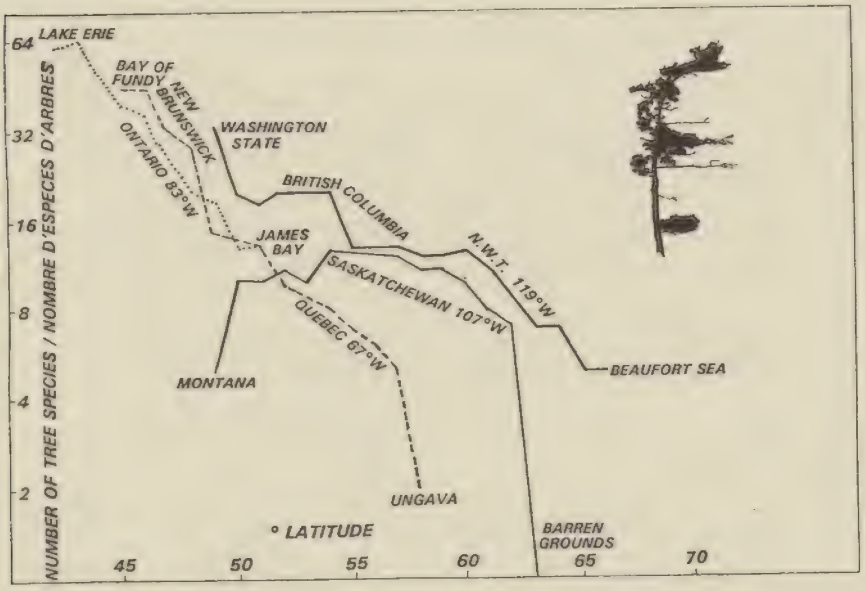

Fig. 4. Number of tree species along north-south (longitudinal) transects in Canada.

5) Even in the present map, with isopleths selected as powers of two, there are fairly close matches between the position of isopleths and the Forest Regions of Rowe (1972).

Closer matches could be found by selecting the best species numbers for the isopleths. The Deciduous Region falls south of the 64-species isopleth, and the Great Lakes-St Lawrence-Acadian regions south of the 32-species isopleth. In the Boreal Forest Region the boundary between "predominantly forest" and "forest & barren" falls a little south of the 8-species isopleth all across the country. In southwestern Alberta and southern British Columbia the interdigitated Subalpine, Coast, Columbia, and Montane regions fall in the broad 16-32 species band.

6) Factors potentially influencing tree biodiversity and requiring evaluation and quantification include: sunshine, temperature and growing season, moisture and fires, habitat-terrain variety, and a historical component, including proximity to glacial refugia and biodiversity of those refugia. Permafrost, erosion of growing tips by blowing snow and sand, waterlogging of soil, soil acidity, soil and foliage, salinization (coastal and inland), and others are also worthy of study.

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ALTERNATE VIEWS ON NATURAL FOREST MANAGEMENT

Readers might wish to supplement their understanding of forestry management based on standard texts and current private sector and government policies by reading some of the following publications. One source of the following books is: New Catalyst Books, P.O. Box 189, Gabriola, B.C. V0R 1X0, Canada.

Camp, Orville. 1984. The forest farmer's handbook: A guide to natural selection forest management. 72 pp. Sky River Press. $8.50. [Many photos and much practical information.]

Harris, Larry D. 1984. The fragmented forest: Island biogeography theory and the preservation of biotic diversity. University of Chicago Press. 212 pp. $14.00. [Bridges the gap between scientists and land managers.]

Léger-Haskell, Diane. 1990. Maxine's tree. Orca Book Publishers. $9.00. [Children's story].

Loomis, Ruth with Merv Wilkinson. 1990. Wildwood, A forest for the future. Reflections. 55 pp. $10.00. [Wilkinson has sustainably logged his 136 acre tree farm 9 times since 1938 and still has a forest. Book explains the practice of sustainable selective logging.]

Mahood, Ian and Drushka, Ken. 1990. Three men and a forester. Harbor Publishing. 272 pp. $27.00. [Forester and form lumber company executive describes problems with timber management, clear cutting and replanting practices.]

Maser, Chris. 1988. The redesigned forest. R. & E. Miles. 256 pp. $16.00. [Restoration forestry by an experienced ecologist.]

Schneider, Aaron. 1989. Deforestation and "development" in Canada and the tropics. The impact on people and the environment. Centre for International Studies. 251 pp. $20.00. [120 articles about shrinking world forests and impacts on indigenous peoples.]

Vance, Joan E. 1990. Tree planning: A guide to public involvement in forest stewardship. B.C. Public Interest Advocacy Center. $12.00.

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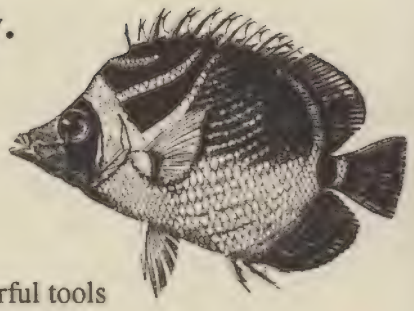
An equal-area grid map for GIS:
A tool for biodiversity conservation and biogeography.



Noel Alfonso
Ocean Voice, 2883 Otterson Drive
Ottawa, Ontario K1V 7B2, Canada

INTRODUCTION

In the face of global declines in biodiversity, conservationists need simple powerful tools to select hotspots of species richness and endemism as well as ecologically unique places for protected areas. Some ecologists are interested in predicting the effects of climatic change on the distribution of wildlife or plants. Biogeography needs quantitative tools to test hypotheses. Geographic information systems (GIS) fulfil part of these needs (Anderson 1984; McAllister *et al.* 1986; Fu 1989).

GIS SYSTEMS AND GRIDS

GIS stores different data sets on a common map system, geographic grid or in facsimile computer files. Correlations or other mathematical operations can then be made between

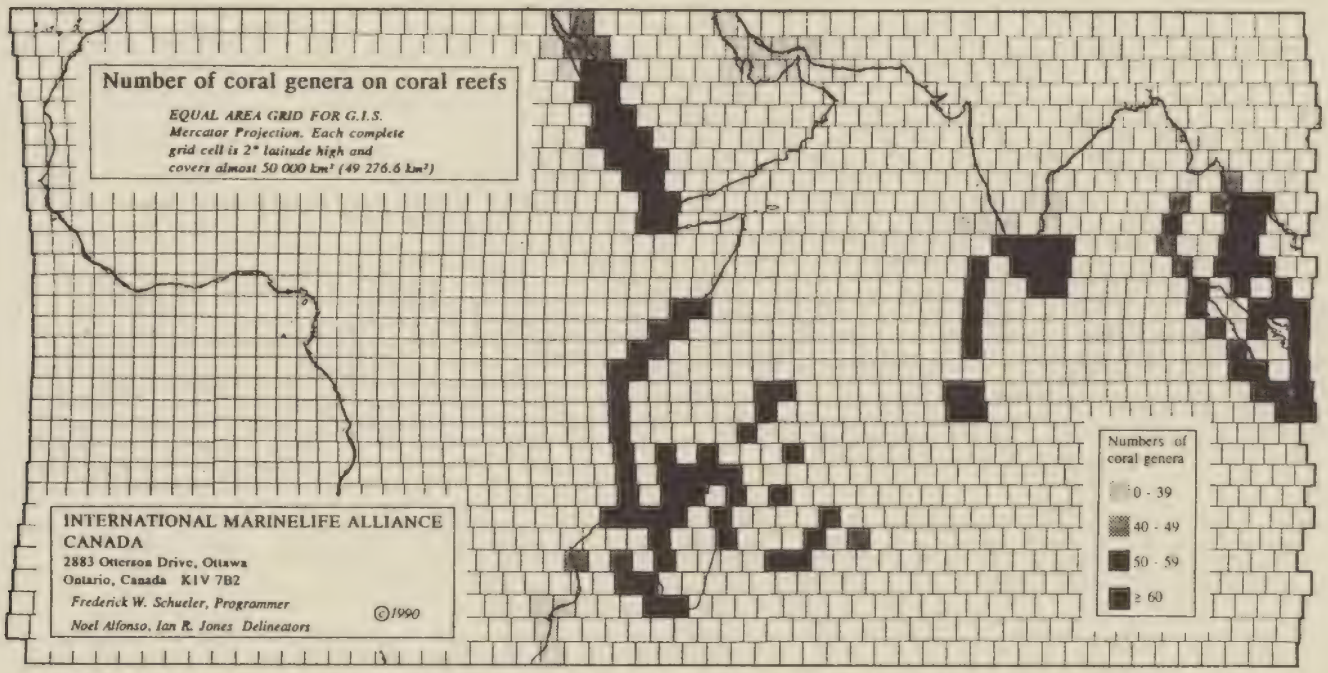


Fig. 1. Part of one of the three of IMAC's new equal-area grid maps for GIS. Each cell represents about 50,000 km². Shading shows the density of genera of reef-building corals and dark clusters show hotspots of coral diversity. An IUCN coral fish study will test how closely coral reef diversity is correlated with coral fish diversity. GIS biodiversity and impact data be can used for research or for priorizing areas to be protected.

the data located at the same point or in the same grid cell. For example simple addition from individual species distribution maps, can produce the number of plant, fish or bird species in a geographic grid cell. Correlations can then be made between the total number of species in a cell and the temperature for that cell. Dependency on temperature and other climatic factors will help predict range shifts in the event of climatic change.

Geographic grids are commonly used to represent the occurrence of species. The "squares" or cells containing the species can be coded in a computer table or matrix with ones, and those lacking the species with zeros. Most studies using geographic grids have used latitude longitude cells, one, two or five degrees wide and long. Latitude longitude grids served admirably for preliminary studies, especially those which do not extend over a wide range of latitudes. This grid system does suffer from one defect, the cells decrease in size towards the poles since the lines of longitude converge towards the poles. This may limit precision in some studies, especially those covering wide ranges of latitude. Owen (1989) has pointed out that the use of quadrats of equal area eliminates the problem of area effects as a confounding variable in statistical analysis.

AN EQUAL-AREA GRID SYSTEM

International Marinelife Alliance Canada (new name **Ocean Voice**) is providing support for the **IUCN SSC Coral Reef Specialist Group**. Goals of the Specialist Group included finding hotspots of coral fish species density, endemism and human impacts. We decided to develop an equal-area grid system for GIS analysis,instead of using cells defined by latitude and longitude. Dr. Frederick W. Schueler developed the mathematics and the program to calculate the locations of the corners of the cells, for a cell size to meet the specifications made by Dr. Don E. McAllister for the coral fish study. They hoped in developing the system, that it might be adopted by other people studying biodiversity, conservation, ecology and biogeography, so that data could be exchanged amongst researchers using the common format.

The area studied lies globally within 30°N Latitude and 30°S Latitude, the limits of almost all known coral species, see Fig. 1. This area was divided into approximately 5342 equal-area cells (about 690 with coral reefs), each equivalent to a 2° X 2° cell with base at the equator. We used a Mercator projection. Due to use of a Mercator projection, geographic features are distorted increasingly towards the poles. But of course the cells have the same area, even if they appear larger polewards on a Mercator projection. The new grid means that a cell at the equator can be directly compared to a cell that is at 30° N - they are both about 50,000 km^2 (precisely 49,551 km^2), the equivalent of a square 223 km on each side.

THE CORAL REEF FISH STUDY

Data is currently being collected, some of it being contributed worldwide by coral fish and coral reef specialists. Data includes information such as presence of coral reefs, number of coral reef genera, number of coral species (data being provided by Dr. Callum Roberts), climatic variables, and measures of human impacts such as population size and

growth, and oil tanker traffic.

Using the equal-area grid the **SSC Coral Reef Fish Specialist Group** hopes to locate hotspots of coral fish diversity and endemism, find how closely linked fish and coral reef genera biodiversity are linked, and what areas are most exposed to human impacts. These results will point the way to determining where to locate protected areas and which areas need priority attention by conservationists.

International Marinelife Alliance Canada will provide base maps for similar marine or terrestrial studies for a modest fee. Interested persons may contact the author at the above address, by telephone at: (613) 992-1133 or by fax at: (613) 996-9915.

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Developing a global biodiversity conservation strategy

Ted Mosquin,
Mosquin Bio-Information Ltd.,
Box 279, Lanark, Ontario K0G 1K0, Canada

A global strategy for the preservation of biodiversity is being developed jointly by **UNEP**, **IUCN** and the **World Resources Institute**. The strategy is being developed for five world regions. Its purpose is to produce an overall strategy and a decade-long action plan that will provide guidelines for policy makers, legislators, NGOs, and individuals. The strategy and the action plan are intended to provide a picture of where the activities of all concerned groups and individuals might best fit and how they complement other activities. It may uncover what changes are needed to better meet the goal of ensuring that richness of the world's biodiversity survives into the indefinite future.

An international coordinating group has been established with members from countries in different parts of the world.

The **Keystone Centre**, Colorado has been asked to coordinate the North American part of the process. A Steering Committee of government and non-government individuals has been established and the Committee's first meeting, which I attended, was held in Toronto on January 10, 1991 to review North American input into the overall process.

The Committee reviewed an early draft statement on the details of a strategy and action plan prepared by the **World Resources Institute** and suggested numerous changes. As well, the Committee reviewed the content and structure of a three day conference to be held at Keystone, Colorado in mid July. The participants at the conference will be asked to react to and redefine the draft strategy and decade action plan, focusing on topics relevant to North America. Workshops of experts will be included dealing with regional ecosystems and other approaches to secure the survival of biodiversity. The results will be published in the fall of 1991, in time to contribute to the **Fourth World Congress on National Parks** in Venezuela in February of 1992, and the **U.N. Conference on the Environment and Development** in June 1992 to be held in Brazil.

The Biodiversity Strategy is a document that will parallel the UNEP Biodiversity Convention initiative of which Canada is a part.

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Re-birth of the Canadian Committee of the International Union for Conservation of Nature and Natural Resources (CCIUCN)

Jacques Prescott
President, Canadian Committee of IUCN
Jardin zoologique du Québec
8191, avenue du Zoo
Charlesbourg, QC, Canada
G1G 4G4

On February 2, 1991, representatives of several conservation organizations, museums and government agencies met at the **Canadian Museum of Nature** to re-launch the activities of the Canadian Committee of the International Union for the Conservation of Nature and Natural Resources (IUCN).

The IUCN is the most important conservation organization in the world. It regroups

some 600 non-governmental organizations and about 120 country members. Amongst the more significant contributions of the IUCN are the famous red books on endangered species (Red Data Books), the *World conservation strategy* published in 1980 and adopted by many countries including Canada, as well as a new document, *Caring for the world,* proposing an updated strategy based on sustainable development.

Canada has been for a long time centrally active in IUCN as much by the financial support it has provided this organization as by the quality of the expertise it has provided them. Unfortunately, in spite of these efforts, the Canadian contribution to the core of IUCN has passed often unnoticed.

With the goal of remedying this lack of visibility and to increase their contribution to the objectives of conservation and sustainable development sanctioned by IUCN, a group of non-governmental organizations and government agencies was convened to re-launch the activities of the Canadian Committee of the IUCN. The meeting on February 2nd brought together about 30 persons representing the Canadian Nature Federation, the Canadian Museum of Nature, the zoos of Québec, Toronto and Calgary, the Canadian Parks and Wilderness Society, Canadian Parks Service, Canadian Wildlife Service, Fisheries and Oceans Canada, Canadian International Development Agency (CIDA), Indian Affairs and Northern Development, External Affairs and International Trade, Québec Ministry of the Environment, and the Institute for Research on Public Policy.

The participants at the meeting were in accord on the importance of pursuing in Canada the diverse goals of IUCN and encouraging the implementation of the resolutions passed during the IUCN's triennial meeting. The members of the Canadian committee wish to play a proactive role in the promotion of the conservation objectives of the Union and to encourage the participation of Canadians on conservation efforts nationally and internationally. The Committee also aims to coordinate the activities of the Canadian members of IUCN in advance of the triennial meetings and on certain subjects of common interest. The Canadian committee saw itself as a center of communications and planning, aiming to assure a more effective Canadian participation in environmental discussions on the international scene.

The Canadian IUCN committee is chaired by Jacques Prescott, its President, also President of the Canadian Nature Federation and General Curator of the Québec Zoological Gardens. He is supported by Dr. Alan Emery, Director of the Canadian Museum of Nature, Dr. Ian Rutherford, of Canadian Parks Service, and Dr. James Patterson of Ducks Unlimited. The members of the executive are supported by a group of six Directors: Ms. Mary Simon, member of the Inuit Circumpolar Conference, Mr. George Green, CIDA, Mr. Gregory Tarry of the Calgary Zoo, Mr. Harvey Mead, Québec Ministry of the Environment, and Mr. David Runnals, of the Institute for Research on Public Policy.

Mr. Runnals, one should point out, was elected IUCN Councillor for North America during the General Assembly of the Union at Perth, Australia, last November.

To become a member of the Canadian Committee of IUCN, or to obtain more information on the activities of this committee, you are invited to communicate with the Permanent Secretariat of the committee at the following address:

Permanent Secretariat, Canadian Committee of IUCN
Canadian Centre for Biodiversity, Canadian Museum of Nature
P.O. Box 3443, Station D
Ottawa, Ontario K1P 6P4, Canada
Attention: Robert McFetridge, tel.: (613) 998-9486
or Shelley McKeller, tel.: (613) 996-9606
Fax: (613) 952-9693

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The destiny of the world rests in the hands of a single species: 1990 Triennial IUCN Meeting[1]

A report on the 18th General Assembly of the IUCN

Dr. David M. Jarzen
Paleobiology Division
Canadian Museum of Nature
P.O. Box 3443, Station D
Ottawa, ON, K1P 6P4

Over a period of eight days starting November 27, 1500 delegates from 120 countries gathered in Perth, Western Australia, to discuss, debate and provide discussions that will affect our daily life and welfare for generations to follow. The event was the 18th General Assembly of the **International Union for the Conservation of Nature and Natural Resources** (IUCN); a powerful union with objectives carefully written to secure the conservation of renewable resources of the earth, and particularly its biological diversity, as an essential foundation for human survival; to ensure that these natural resources are developed and used in a wise and sustainable way; and to guide the development of human communities towards ways of life that are of both good quality and in enduring harmony with nature.

The triennial gatherings, as I observed, are extremely well organized, appropriately democratic and through the day and evening sessions, which may be long yet enduring, provide results that will effect major changes in human use of the environment.

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[1] From the **IUCN** Declaration of Fontainebleau.

The opening ceremony was replete with political dignitaries including his Royal Highness The Duke of Edinburgh (President of the **World Wide Fund for Nature**); The Honorable R.J.L. Hawke, Prime Minister of Australia; The Premier of Western Australia, The Minister for Arts, Sport and the Environment; and the Deputy Executive Director of for the **United Nations Environment Program** (UNEP).

The Perth weather was nearly idyllic and provided a background of a near perfect world. The discussions within the convention rooms, however, soon indicated the nature of our world's environmental health as tedious and critical.

The **IUCN**, also known as **The World Conservation Union**, provides a forum for State Governments, Government Agencies (of which the **Canadian Museum of Nature** is a member), and Non-Government Agencies (such as **Greenpeace, The Sierra Club**, etc.) to present resolutions for consideration and discussion, leading to either acceptance or rejection of proposals to safeguard our planet's natural resources. The list of resolutions (nearly all of which were eventually adopted, some in modified form) of more than 100 items covered the full array of current thought on the problems which we face today which will affect our lives and the biodiversity and sustainability of our environment. Issues of prime concern were, of course, ozone depletion, biodiversity, climatic change and environmental degradation.

Discussions which included wet tropical environments, Antarctica, wetlands, and marine environments were perhaps those involving more of the participants. These far-reaching, high profile concerns received comments and debate that transcended simple "right or wrong", but brought into play the needs of developing countries to "appropriately" exploit these environments.

The **IUCN** delegation approved a proposal including total ban on all mining and exploration of Antarctica, while noting the objections to a total ban by the U.K. and U.S.A. Not all resolutions were as hotly debated as those concerning the last frontier - Antarctica.

The Canadian delegation to the **IUCN** included members from the **Canadian Association for Humane Trapping, Canadian International Development Agency (CIDA), Canadian Museum of Nature (CMN), Canadian Wildlife Federation, Ducks Unlimited Canada, Environment Canada, External Affairs Canada, Fur Institute of Canada, Greene Associates, Inuit Circumpolar Conference, International Institute for Sustainable Development, NWT Department of Renewable Resources, PADATA, Quebec Ministry of the Environment, University of Alberta Protected Areas Management Program, University of Waterloo Heritage Resources Centre, Wilfred Laurier University Department of Geography, World Wildlife Fund (WWF), Wood Bison Re-establishment Foundation**. The **CMN** has in the past maintained "observer status" within the **IUCN** membership structure. With the 18th General Assembly, however, the **CMN** upgraded its position to full Government Agency Member with all the privileges and voting rights as granted to all delegates. My attendance at these

meetings was not only to represent the CMN and its concern for world conservation, but more importantly to serve as a learning experience for myself and become more involved as a research scientist in the mainstream of world conservation. Species diversity and environmental diversity will be important areas of high profile studies over the next several decades. Perhaps the study of past environments and species extinctions that I am involved with in my research, will serve as keys to today's problems of climate change and species survival. Perhaps the "past will become the key to our future."

We, as a museum, must act swiftly to act as guardians of our world's natural heritage, to provide the scientific expertise, biological surveys, biotic collection and diversity computer data bases necessary to conduct appropriate biosystematic and biodiversity studies and the reporting of environmental degradation as observed in species numbers, geographic range displacements, extirpations[2], and indeed extinctions.

Time goes swiftly on its way.
All too soon we've lost today.
I cannot wait for skies of blue
Or dream so long that life is through.

From **Flying free** by D. Besig

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Biodiversity News Notes

A new zoological name code in the making: How to name 30 million species

The International Code of Zoological Nomenclature guides zoologists in forming new names and choosing between old names for the approximately one million species of animals already described and the up to 30 million remaining species estimated to still require discovery and description. The International Commission on Zoological Nomenclature met during 4-5 July 1990 at the University of Maryland and developed a set of fundamental principles for the preparation of the 4th edition of the International Code. Three primary principles were supported: the promotion of stability and universality (including validation of names in current use rather than following strict priority); the assertion that the names are simply symbols representing taxa that enhance communication and enhance development of information bases (hence details of spelling, Latinization, etc. are secondary); and that the provisions of the Code must be simplified to insure easy automatic application of them by practising systematists with minimum need to petition the Commission. An editorial committee is drafting these changes into

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2 Extirpation is the disappearance of a species in part of its range, e.g., regionally or nationally. This contrasts with extinction where all of the members of the species disappear.

a definitive form for meetings of the International Union of Biological Sciences at Amsterdam, the Netherlands, September 1991. Comments may be sent to the Executive Secretary, International Commission on Zoological Nomenclature, c/o Museum of Natural History, Cromwell Road, London SW7 5BD, UK.

Chinese Plant Biodiversity

Dr. Peter Raven, Director of the **Shaw Garden** in Missouri and the Peoples Republic of China have signed an agreement to publish an English translation of an encyclopedia of Chinese plants. The encyclopedia contains 30,000 plants. The project will take 15 years and will run to 25 volumes of 250 pages each. The volumes will be illustrated with line drawings. William Tai, a Canadian botanist, has been hired to co-ordinate the project. The Chinese version of the **Flora of China** took 30 years to write under the principal authorship of Prof. WU Zheng-yi. More than 6,000 species of Chinese plants are commonly used for medicines. The translation will make this valuable information accessible to the world and to pharmaceutical researchers.

CCFR Meeting on Fish Biodiversity

The **Canadian Conference for Fisheries Research** held its annual meeting at the Institute of Ichthyology, University of Guelph, Ontario January 2-4, 1991. One of the themes of papers presented was biodiversity, another was sustainable fisheries. Papers included the following: Quantifying biodiversity by Julian Dodson; Maintaining biodiversity by Peter Ihssen; Manipulating biodiversity by Tillmann Benfey; Biodiversity of freshwater fishes in B.C. by J.D. McPhail; Morphological and molecular genetic studies of diversity in NE North American populations of smelt, *Osmerus*, with contrasting life histories by E.B. Taylor & P. Bentzen; Hypervariable genetic markers cloned from the DNA of fishes by P. Bentzen, A.S. Harris & J.M. Wright; Genetic variation and fitness by A.P. Liskauskas & M.M. Ferguson; Lack of genetic population subdivision of American plaice, *Hippoglossoides platessoides*, in the Gulf of St. Lawrence; Loss of exploited, indigenous populations of lake charr, *Salvelinus namaycush*, caused by stocking of hatchery stocks; Displacement of bull charr from lakes - the lake charr connection by D.B. Blood; In search of phenotypic stability within environmental noise by G. Chaput; and A comparison among native lake, pond, and hatchery reared walleyes using meristic counts by J.G. Brown. Some copies of the abstracts are available from Dr. F. William H. Beamish or Dr. Eugene K. Balon, of the new **Institute of Ichthyology, University of Guelph**, Guelph, Ontario N1G 2W1, Canada.

Endangered species increase in Canada

World Wildlife Fund Canada announced that last year 13 species were added to the Canadian Endangered Species List. This brings the total number of endangered species to just under 200. Donations to **World Wildlife Fund Canada** contribute towards reversing this trend and can be sent to them at 90 Eglinton Avenue E., Suite 504, Toronto, Ontario M4P 2Z7, Canada.

Coming meetings on biodiversity

February 11-12, 1991. **Zebra mussels - mitigation options for industries.** For information contact in the Toronto, Ontario (Canada) area: Paul M. Wiancko, Conference Organizer at (416) 592-4599 or Renata Claudi, Program Coordinator at (416) 592-9140.

March 12-15, 1991. **Biodiversity of the Rocky Mountains**. Will be held at Colorado State University, Fort Collins, Colorado. For information contact:

Dr. Fritz L. Knopf
Fish and Wildlife Service
National Ecology Research Center
4512 McMurray Avenue
Fort Collins, CO, U.S.A, 80525
Telephone (303) 226-9462

March 20-25, 1991. **International Conference on Museums and Environmental Issues** to be held at Beidaihe, 300 km east of Beijing, China. Beidaihe is a well-known summer resort and the meetings will be held at the Jinshan Guest House, a modern first-class garden hotel. The meeting is organized by the **International Committee of Natural History Museums** (ICOM) and the **Chinese Association of Natural Science Museums** in association with the China International Conference Center for Science and Technology, the National Commission for Science and Technology and the Beidiahe International Travel Service. The conference is expected to attract more than 150 members from museums, universities and scientific research institutes around the world, as well as 100 Chinese scientists. Main conference topics include: Museums and biological diversity; museums and global change; museums and the marine environment; museums and endangered species; museums and national parks and nature reserves. Registration for overseas participants is to be made to:

ICOM/Natural History Committee
c/o Dr. Craig C. Black
Los Angeles County Natural History Museum
900 Exposition Boulevard
Los Angeles, California 90007, U.S.A

April 14-19, 1991. The World Fisheries Congress symposia themes include: **Protection of aquatic biotic diversity** and **Fisheries impacts on biodiversity.** For more information contact: World Fisheries Congress
American Fisheries Society
5410 Grosvenor Lane
Bethesda, Maryland 20814, U.S.A.

May 8-11. Feature symposium: **Climate change and the boreal forest**. At the 30th Annual Conference of the **Canadian Society of Zoologists** to be held at Lakehead University, Thunder Bay, Ontario, with lectures, symposia, contributed papers, posters, and student competitions. For more information write:

Canadian Society of Zoologists 30th Annual Conference
c/o Mrs. Diana Abraham
Department of Zoology
Lakehead University
955 Oliver Road
Thunder Bay, Ontario P7B 5B1, Canada
Fax: (807) 343-8023.

June 15-20, 1991. **Symposium on Conservation of Biodiversity of Fishes, Amphibians, and Reptiles**. This will be sponsored by the **American Society of Ichthyologists and Herpetologists** at their annual meeting in New York city. Already 59 papers on fauna of North and South America and Asian have been confirmed. For more information contact:

James D. Williams
USFWS, National Fisheries Research Center
7920 N.W. 71st Street
Gainesville, FL 32606, U.S.A.
Tel.: (904) 378-8181, Fax (904) 378-4956.

June 1992. **Global conference on Environment and Development**
For information contact: Information Officer

Economic Commission for Europe
Palais des Nations
CH 1211 Geneva 10
Switzerland, Tel.: 734 60 11, Fax 734 98 25
or
Jean-Claude Faby
United Nations Environment Program
Tel.: (212) 963-8098

Book & Periodical Niche

Conserving the World's Biological Diversity
By J.A. McNeely, K.R. Miller, W.V. Reid, R.A. Mittermeier and T.B. Werner. 1990. IUCN, WRI, CI, WWF-US and the World Bank. ISBN: 0-915825-42-2. Available from: IUCN Publications Services, CH-1196 Gland, Switzerland; WRI Publications, P.O. Box 4852 Hamden Station, Baltimore, MD 21211; World Bank Publications, P.O. Box 7247-8619, Philadelphia, PA 19170-8619, US$14.95.

Within the 193 pages of this softcover compendium is a wealth of information dealing with all aspects of biodiversity that makes informative reading for a wide audience. Beginning with an explanation of what is meant by biological diversity, the authors follow by documenting its economic importance and the ethical reasons for its conservation. Numerous tables summarize data on such topics as rates of deforestation and wildlife habitat loss in the tropics, numbers of protected sites worldwide, current status of threatened species and areas of greatest species diversity. Considerable attention is focused on conservation and management issues, further information required at local, national and international levels to ensure success of conservation efforts and in presenting approaches and guidelines for determining priorities for conservation actions. Because of the complexity of the problem and advanced stage of biodiversity degradation, strategies and action plans are required and proposed for species and habitat conservation. Suggestions on how to pay for some of the enormous costs of conservation efforts are explored and the need to engage non-conservation sectors and adopt new approaches to managing protected areas are presented.

The publication is replete with photographs, maps, and text boxes highlighting biodiversity in countries of special significance. These and the six annexes dealing with such background information as The World Charter of Nature and the 14 pages of bibliographic references on all aspects of the subject of biodiversity conservation makes this a valuable and timely reference work. No restrictions are placed on reproduction for educational and non-profit uses.

Erich Haber, Botany Division, Canadian Museum of Nature

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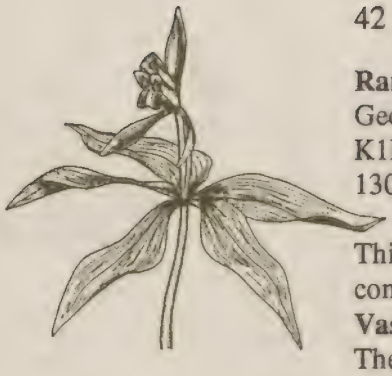
Biological invasions: A global perspective
By J.A. Drake, H.A. Mooney, F. diCastri, R.H. Broves, F.J. Kruger, M. Rejmanek and M. Williamson. 1989. John Wiley and Sons, New York. 525 pp. $159.00 U.S.

Twenty-two chapters present an assessment of where we are in our evaluation and understanding of the dramatic rearrangement of the earth's biota that has taken place over the last few centuries. The theoretical and applied studies describe and explain plant and animal invasions. D.E.M.



Rare Vascular Plants in Canada - Our Natural Heritage
George W. Argus and Kathleen M. Pryer. 1990. Canadian Museum of Nature, Ottawa, K1P 6P4, Canada. 191 pp. (192 pp. in French edition) + 43 pp. maps. ISBN: 0-660-13053-X.

This work is the culmination of four years of compilation and updating of information contained in the lists of provincially rare vascular plants and the **Atlas of the Rare Vascular Plants of Ontario** published by the **Canadian Museum of Nature** (formerly The National Museum of Natural Sciences). The *Rare and Endangered Plants Project* at the museum, under the leadership of George Argus, has provided the stimulus and guidance for the production of most of the provincially rare plant lists published since 1977 in the museum's Syllogeus series. These have served as baseline documentations upon which provincial and federal agencies, conservation groups and consultants have relied for initiating their own investigations and conservation efforts on rare plants.

The heart of the publication is an annotated list of 1009 nationally rare vascular plants representing nearly one third of Canada's native flora. The basis for inclusion of a species is that each must be rare in every province or territory in which it occurs. The main purpose of the list is to provide a source of objectively derived priority rankings that could be used for assessing relative priorities of rare species for conservation management. To this end, species entries focus on presenting information on two ranking systems. One set of data are the **Nature Conservancy** Element Ranks, which provide an overview on the status of a rare species globally, nationally, as well as by province or state. The Canadian priority ranking for each species, developed by the authors, is based in part on this system but additionally takes into account the Canadian distribution of a listed species, its population size and threats. The two ranking systems are explained in the introductory pages and the Canadian ranking data are graphically summarized in histograms that reflect the relative distributions of the priority classes overall in Canada and by province and territory.

For ease of access to species names and rankings, this list, like the provincial forerunners, is alphabetically arranged. Appendices group species by family, province and territory, and Canadian priority rank. Simplified distribution maps give an overview of the range of each species in North America. Because of the large numbers of rare plants in Canada, of which only a small number have been considered for status designation by the Committee on the Status of Endangered Wildlife in Canada or by provincial jurisdictions, there is an urgent need to optimize the limited resources available for conservation efforts. This soft cover publication will no doubt serve as the primary "red data book" for Canadian rare vascular plants that will provide managers with an objective and authoritative decision-making tool for priorizing rare plant conservation activities and funding.

Available in English or French from: **Canadian Museum of Nature**, Direct Mail Section, P.O. Box 3443, Station "D", Ottawa, Canada K1P 6P4. Price: in Canadian funds, $16.95; U.S.A. $18.95 (postage, handling & taxes included). Erich Haber, CMN.

ARABIAN-PERSIAN GULF STUDY
Marine fishes of Iran: Checklist and bibliography
By Brian W. Coad. 1991 [in press]. Canadian Museum of Nature, Syllogeus, 1-210 pp.

This book is announced ahead of publication because of its pertinence to the huge oil slick spreading from Kuwait in the Gulf. The volume covers the whole Gulf plus the Sea of Oman. 850 marine species are recorded from the area and a very complete bibliography to fish studies on the region is provided. Some of the species records are also documented by collections, made by the author and others, in the **Canadian Museum of Nature**. The introduction includes an excellent summary of human impacts and the state of the marine environment in the Gulf area. This volume should be a useful reference to those studying the impact of the Kuwait oil spill. D.E.M.

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Exotic species & the shipping industry: The Great Lakes-St. Lawrence ecosystem at risk
By IJC and GLFC. 1990. A special report to the Governments of the United States and Canada. International Joint Commission and the Great Lakes Fishery Commission. International Joint Commission, 100 Metcalfe Street, 18th floor, Ottawa, Ontario K1P 5M1. Tel.: (613) 992-4109, Fax: (613) 993-5583.

The health and integrity of the Great Lakes Basin Ecosystem, including the 40 million humans who live in the basin, are jeopardized by an immediate and growing problem: the rampant colonization by shipborne exotic organisms. This problem is exemplified by the massive spread of zebra mussels through the Great Lakes which is displacing native bottom biota, reducing plankton populations through filtration, and disrupting flow of intake pipes for water used for cooling, drinking and other purposes. Other exotic introductions are known, and a number are suspected to have been introduced in ships' ballast water carried from other regions. Six recommendations are made on the problem.

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Molecular systematics
Edited by D.M. Hillis and C. Moritz. 1990. Sinauer Associates Inc., Sunderland, Massachussetts. 588 pp. US $37.95. (paperback).

Provides a guide to theory and methods of molecular taxonomic studies. Chapters include molecular taxonomy, sampling and storage of tissues, isozyme electrophoresis, immunology, molecular cytogenetics, DNA-DNA hybridization, restriction site analysis, sequencing, within species differentiation, phylogeny reconstruction, and uses of molecular systematics. D.E.M.

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Potential effects of global warming on native fishes of the southern Great Plains and the Southwest
By W.J. Matthews and E.G. Zimmerman. 1990. Fisheries 15(6): 26-31.

Discusses fishes of the western drainages of the Mississippi Basin and tributaries of the western Gulf of Mexico. Proposes that if 3-4°C warming occurs that a number of fish species in this region face extinction. Some are already in water close to the thermal limits of the species, others would be unable to migrate northwards to cooler waters. Suggests that the outlook is bleak for fishes of this region. D.E.M.

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Biodiversity Network News
Newsletter of The Nature Conservancy, 1815 N. Lynn Street, Arlington, VA 22209, U.S.A.

The **Biodiversity Network News** is published quarterly by the Nature Conservancy for Heritage, Conservation Center and compiled and written by the Nature Conservancy staff, volunteers and cooperators. Newsletter Volume 3, Number 4 in 1990, contains 8 pages printed in black and green on recycled paper. The first article discusses using the Conservancy for Heritage's program data banks to develop a conservation strategy for the coastal plain pond flora of North America. Three brief articles on **Ecology, Animals** and **Plants** describe the drafting of a regional classification of natural communities in southeastern U.S., the declining status of migratory bird populations that breed in North America and winter in the tropics, and the Conservancy's cooperation with other institutions at a meeting in Greece to develop standards for scientific, geographic and floristics information. The next article discusses computers and data management in the Biological and Conservation Data System (BCD). Notes are recorded on the Eastern/-Southern and Western/Midwestern Heritage Conferences, and networking with the U.S. Forest Service, National Park Service and the U.S. Fish and Wildlife Service. A new Conservation Data Center is announced for Jamaica. This center is being established at the University of the West Indies' Mona Campus and will help in conserving the nearly 800 species of endemic plants, 25 endemic birds and many endemic reptiles and amphibians on the island (no mention is made of fishes). D.E.M.

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Biodiversity loss in the temperate zone: Decline of the native fish fauna of California
By Peter B. Moyle and Jack E. Williams. 1990. Conservation Biology 4(3): 275-284.

Of 113 native fish taxa, 6% are extinct, 12% are officially threatened or endangered, 6% deserve immediate listing, 17% may decline soon, 22% show declining populations and only 36% appear to be secure. The major problems appear to be water diversions and introduced species, although habitat degradation also contributes. These losses may reflect a general decline of the biota of temperate parts of the world and that propor-

tionately the loss of species may be as great in temperate as in tropical regions. D.E.M.

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The New Catalyst
By the New Catalyst, P.O. Box 189, Gabriola, B. C. V0R 1X0, Canada. Free.

This periodical is in mini-newspaper format with colored images. Issue Number 19 for fall 1990 focused on communities forest strategies. Articles in this issue include: Let B.C.'s forest live!; A call for a natural economy; The new forestry (whole ecosystems, landscape-watersheds, sustainability, biodiversity, ecosystem functions), reports on the Slocan and Yalakom valleys Saltspring Island and Clayoquot Sound.

Parks
Science and Technology Letters, P.O. B. 81, Northwood, Middlesex HA6 3DN, England, or Science Reviews Inc., 707 Foulk Rd., Suite 102, Wilmington, DW 19803, U.S.

Parks, according to their brochure, is an international magazine dedicated to the protected areas of the world. For managers of protected areas, **Parks** is a practical journal dealing with natural, historical and cultural values of national parks and other protected areas. It covers all aspects of the planning, use and management of these areas throughout the world. **Parks** is published by Science and Technology Letters on behalf of the Commission on National Parks and Protected Areas of **IUCN** - The World Conservation Union. It is funded in part by: **The Canadian Parks Service, The U.S. National Park Service, The Australian Department of Arts, Sport, the Environment, Tourism and Territories.** Two issues were to be published in 1990 at US$37/£20 per single copy and 3 issues in 1991 at $55/£30 per single copy from the above addresses.

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Alternatives, Perspectives on society, technology and environment
By Faculty of Environmental Studies, University of Waterloo, Waterloo, Ontario N2L 3G1, Canada. ISSN 0002-6638. Tel.: (519) 885-1211, ext. 6783. In Canada: Can.$17.50 (individuals), $35 (institutions), elsewhere $22.50 and $45, respectively.

This issue of **Alternatives** includes feature articles on: conservation strategies; sea changes; Prince Edward Island conservation strategies; forest conservation in Canada; state of the environment reports and sustainable development. Reports are included on: sewage treatment; escaping oil tyranny; the Canadian link in the Salvadorean nuclear accident; Peigans fight Oldman dam; and lead in waterfowl habitat. D.E.M.

Directory. Species Survival Commission Membership Directory
By Maria Dopazo. 1990. IUCN - The World Conservation Union. Gland, Switzerland. 254 pp. Paperback.

This directory lists members of the various SSC's executive and specialist groups. At the end are listed the names and addresses of individual members. Specialist groups include Asian rhino, bear, bison, deer, hyrax, heron, seabird, marine turtle, freshwater fish, ant, mollusc, Odonata, fungi, cycad, orchid, palm, captive breeding, ethnobotany, trade and veterinarian. This is a useful source of expertise for conservationists. D.E.M.

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The role of educational institutions and non-government organizations (NGOs) in the sustainable management of the environment and natural resources.
By The Environmental Education Network of the Philippines (EENP). 1989. Secretariat: Institute of Environmental Sciences and Management, University of the Philippines at Los Baños College, Laguna, Philippines. 21 pp.

This booklet discusses the need for environmental education in the Philippines, current intiatives for environmental development and conservation, status and profile of environmental education in the Philippines, environmental problems and issues, proposals and recommendations. An annex provides a partial list of ENGOs (Environmental Non-Government Organizations) in the Philippines. This is an excellent study and shows how to approach the priority problem of educating people about the environment. D.E.M.

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The politics of preserving biodiversity
By Peter H. Raven. 1990. Amer. Inst. of Biological Sci., AIBS News 40(10): 764-769.

This is an excellent review of the state of the world's biodiversity by one of its deans, and of the politics of biodiversity in the United States. Read it!

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A prairie coulee
By Thomas Willock. 1990. Lone Pine Publishing, #206 10426 - 81 Avenue, Edmonton, Alberta T6E 1X5, Canada. 95 pp. Can$8.95. Paperback. ISBN 0-919433-56-1.

This book explores the rich environmental world of the coulee of southern Canada and northern U.S. Coulees are the steep-walled ravines or creek beds, seasonally sometimes dry, in the North American prairies. Coulees form an oasis of biodiversity, moisture and shadow in the drier, now rather thoroughly cultivated prairies into which they are carved by forces of glacial drainage and recent water flow. Tom Willock writes lyrically, and knowledgably from his lifetime of experience in Alberta and Montana. D.E.M.

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Garbage, The practical journal for the environment
Published 6 times annuallly by Old-House Journal Corp., 435 Ninth Street, Brooklyn, N.Y., U.S.A. 11215. ISSN 1044-3061. US$21 annually in U.S.A.; US$29 in Canada.

A great thought-provoking magazine, hopefully to be reviewed in a later issue.

Home place. Essays on ecology
By Stan Rowe. 1990. NeWest Publishers Ltd., #310-10359 - 82nd Ave., Edmon-ton, AB T6E 1Z9, Canada. 253 pp. Can$14.95. Paper. ISBN 0-920897-78-9.

This soft cover book includes 28 short essays on "human ecology" written in delightful prose. It is a capsule summary of a life long experience with ecological research and thinking about the deeper value of ecosystems by Canada's foremost ecologist. It explores the ecological notion of Earth as the only "home place" for us humans and all companion life forms. The common theme is that soil, air, water, species, ecosystems and the enveloping Ecosphere itself comprise a powerful, evolving unity, whose ethical value is largely unsensed by humans. Rowe describes how the profound lack of valuation of the Earth's natural systems is at the root of the accelerating destruction of the Earth as advocated by economists, bureaucrats, politicians and others.

The book challenges and undermines the premises upon which the current unlimited growth ethic is founded. In this sense it is among the most perfectly radical and powerful books on this important subject that I have ever read. "Radical" here is used in its true positive meaning as "of or from the root or roots; going to the centre, foundation or source of something".

The major grouping of essays include: Virgin Prairie Farewell, Facing Reality, Growing Up, Strictly Academic, Agriculture, Trade and Travel, and Envoy.

The book is timely, in the sense that people are looking for answers to the environmental crisis. It presents a direct challenge to conventional ways of thinking so widespread among old-fashioned economists, advocates of never-ending growth, foot-dragging bureaucrats and other negative and destructive elements in society. The book offers hope and a way out, by outlining a clearcut alternative set of values based upon ecological premises. It challenges the official ideology that humanity is the end all and be all of this world. Concluding he says:

"Not realizing that we are Earthlings with responsibilities and rights that living well in the Home Place entail, we have tried to anchor our natural sense of belonging in fables of special creation, arrogating God's image as the mirror of ourselves."

This book is very highly recommended for the general reader who wants to know what ecology is about. It should be read by staff of **Environment Canada,** all federal and provincial agencies that are active in making policies affecting the Ecosphere. If you read this book, you will never be the same.

Ted Mosquin
Mosquin Bio-Information Ltd.
Box 279, Lanark
Ontario K0G 1K0, Canada

Illustration of Small Whorled Pogonia - Petite pogonie verticellé, ***Isotria medeoloides*** *(Pursh) Raf. An endangered species found in Ontario.*

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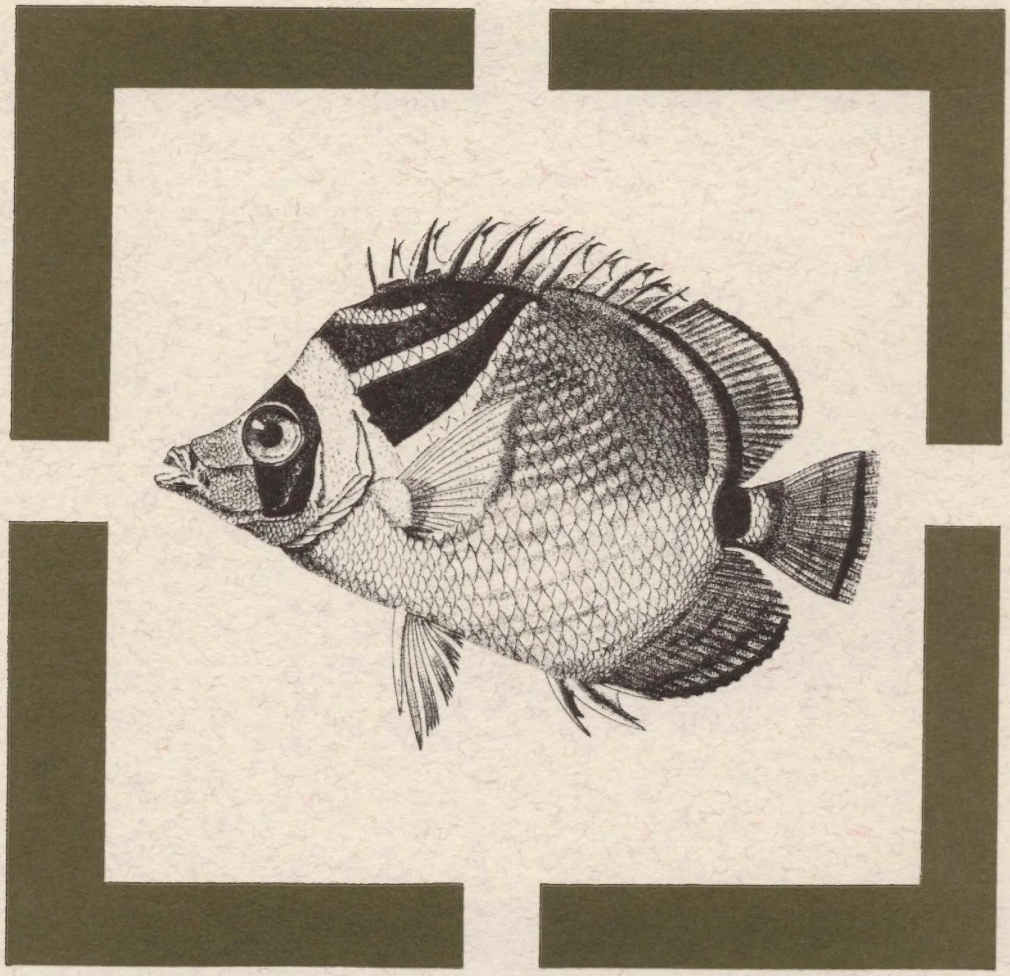

Everybody can be great, because anybody can serve.
Martin Luther King, Jr.

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